

AMENDMENTS TO THE CLAIMS

1-4. (Cancelled)

5. (Currently Amended) A method of forming a copper interconnection on a semiconductor device, said method comprising:

forming an auxiliary seed layer for reinforcing a copper seed layer in an interconnection groove defined in a surface of the semiconductor device using an electroless copper plating liquid containing dihydric copper ions, a complexing agent, and an aldehyde acid and ~~excluding alkaline metals and endocrine disruptors an organic alkali~~; and

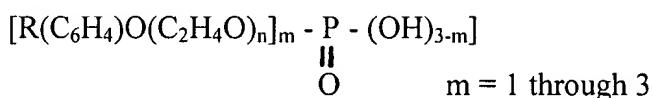
performing an electrolytic plating process using the seed layer including said auxiliary seed layer as a current feeding layer, for thereby filling copper in the interconnection groove defined in the surface of the semiconductor ~~device. device,~~

provided that said method is conducted without any alkaline metals and endocrine disruptors.

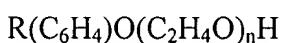
6. (Original) A method of forming a copper interconnection according to claim 5, characterized by performing an electroless copper plating process at a plating rate of 50 nm/min. or less using said electroless copper plating liquid.

7. (Original) A method of forming a copper interconnection according to claim 5, characterized in that said electroless copper plating liquid contains polyoxyethylene alkylphenylether phosphoric acid and/or polyoxyethylene alkylphenylether, which has the structure indicated below, at a concentration ranging from 1 to 100 mg/L:

(polyoxyethylene alkylphenylether phosphoric acid)



(polyoxyethylene alkylphenylether)



8. (Original) A method of forming a copper interconnection according to claim 5, characterized in that said complexing agent comprises EDTA·4H (ethylenediaminetetraacetic acid),

said aldehyde acid comprises a glyoxylic acid, and said organic alkali comprises TMAH (tetramethylammonium hydroxide).

9. (Original) A method of forming a copper interconnection according to claim 8, characterized in that said copper ions have a concentration ranging from 0.01 to 10.0 g/L, said EDTA·4H has a concentration ranging from 0.5 to 100 g/L, said glyoxylic acid has a concentration ranging from 1 through 50 g/L, and the electroless copper plating liquid has a pH adjusted to a range from 10 to 14 by said TMAH.

10-17. (Cancelled)

18. (Currently amended) A method for forming copper interconnections within recesses in a surface of a semiconductor substrate, said method comprising:

providing a substrate with a copper seed layer within recesses in a surface of the semiconductor substrate;

forming an auxiliary copper seed layer for reinforcing the copper seed layer within the recesses using an electroless copper plating liquid ~~excluding alkaline metals and endocrine disruptors~~ at a plating rate of equal or less than 50nm/min; and

filling copper in the recesses by an electrolytic plating process using the reinforced copper seed layer as a current feeding layer,

provided that said method is conducted without any alkaline metals and endocrine disruptors.

19. (Previously presented) A method according to claim 18, wherein at least one of the recesses has an inlet size of less than 0.18 μm .

20. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains dihydric copper ions.

21. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains a complexing agent.

22. (Cancelled)

23. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains an organic alkali.

24. (Previously presented) A method according to claim 21, wherein said complexing agent comprises EDTA• 4H (ethylenediaminetetraacetic acid).

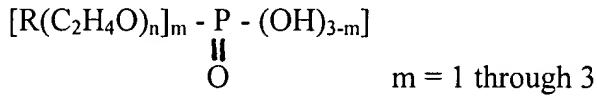
25. (Cancelled)

26. (Previously presented) A method according to claim 23, wherein said organic alkali comprises TMAH (tetramethylammonium hydroxide).

27. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid contains polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether at a concentration ranging from 1 to 100 mg/L.

28. (Previously presented) A method according to claim 27, wherein said polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether has a structure indicated below:

(polyoxyethylene alkylether phosphoric acid)



(polyoxyethylene alkylether)

$RO(C_2H_4O)_nH$.

29. (Previously presented) A method according to claim 20, wherein said copper ions have a concentration ranging from 0.01 to 10.0 g/L.

30. (Previously presented) A method according to claim 24, wherein said EDTA•4H has a concentration ranging from 0.5 to 100 g/L.

31. (Cancelled)

32. (Previously presented) A method according to claim 26, wherein the electroless copper plating liquid has a pH adjusted to a range from 10 to 14.

33. (Previously presented) A method according to claim 18, wherein said electroless copper plating liquid comprises an aldehyde acid as a reducing agent.

34. (Previously presented) A method according to claim 33, wherein said aldehyde acid comprises a glyoxylic acid.

35. (Previously presented) A method according to claim 34, wherein said glyoxylic acid has a concentration ranging from 1 through 50 g/L.